WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Unfolding the Secrets of Biophytum sensitivum: Botanical, Pharmacological, and Therapeutic Insights

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ABSTRACT

Biophytum sensitivum (L.) DC., a herbaceous plant belonging to the family *Oxalidaceae*, has long been revered in traditional medicine systems such as Ayurveda, Siddha, and folk practices for its diverse therapeutic applications. Commonly known as the "sensitive plant" due to its rapid leaf-folding response to touch, *B. sensitivum* has garnered scientific interest for its rich phytochemical profile and wide spectrum of pharmacological properties. This review provides a comprehensive overview of the botanical characteristics, ethnomedicinal uses, phytochemical constituents, and pharmacological activities of *B. sensitivum*. Key bioactive compounds, including *amentoflavone*, *isoorientin*, and various *phenolics and flavonoids*, have been identified as contributors to its antioxidant, anti-inflammatory, antimicrobial, anti-diabetic, immunomodulatory, anti-tumor, and wound healing properties. In vitro and in vivo studies support many traditional claims and highlight its potential role in managing chronic and infectious diseases. However, despite its promising bioactivity, further clinical and mechanistic studies are required to fully elucidate its therapeutic potential and ensure its safe integration into modern pharmacotherapy. This review aims to consolidate current knowledge and identify future research directions for the medicinal development of *Biophytum sensitivum*.

Keywords: Biophytum sensitivum, amentoflavone, medicinal plant, phytochemicals, pharmacological activity, traditional medicine, Oxalidaceae.

INTRODUCTION

Biophytum sensitivum (L.) DC., a small annual herb belonging to the family *Oxalidaceae*, is widely recognized for its distinctive touch-sensitive foliage and its broad spectrum of therapeutic applications. Commonly referred to as the "little tree plant" or "sensitive plant," this species is native to tropical Asia and Africa and is found abundantly in India, Sri Lanka, and Southeast Asian countries. It thrives in moist and shaded habitats and has long held a significant place in traditional medicine systems, particularly Ayurveda, Siddha, and folk medicine.The ethnomedicinal value of *Biophytum sensitivum* is profound, with various parts of the plant being used to treat a wide array of ailments, including wounds, inflammation, asthma, diabetes, tumors, and infections. Traditionally, it has been employed as an anti-inflammatory, antioxidant, anti-diabetic, immunomodulatory, and antimicrobial agent. Its unique ability to respond to mechanical stimuli, such as touch or light, has also made it a subject of botanical curiosity and scientific investigation.

Phytochemical analyses have revealed that *Biophytum sensitivum* is a rich source of bioactive compounds such as *flavonoids, phenolic acids, tannins, terpenoids, saponins, and polysaccharides*. Among these, *amentoflavone*, a biflavonoid compound, has been extensively studied for its potent pharmacological properties. These secondary metabolites are believed to be responsible for the plant's therapeutic potential and are increasingly gaining attention in pharmacognosy and phytopharmacology research.Over the past two decades, a significant number of experimental studies—both in vitro and in vivo—have been conducted to validate the traditional claims surrounding *B. sensitivum*. These studies have documented its role in modulating various biological pathways, including oxidative stress, inflammation, angiogenesis, and apoptosis, thereby underscoring its potential as a natural source for developing novel therapeutic agents.Despite the growing body of research, the available information on *Biophytum sensitivum* remains scattered across ethnobotanical records, pharmacological reports, and phytochemical studies. There is a compelling need to consolidate and critically evaluate the current state of knowledge regarding this promising medicinal plant.

This review aims to provide a comprehensive and up-to-date synthesis of the available literature on *Biophytum sensitivum*, encompassing its *botanical characteristics, traditional uses, phytochemical profile, pharmacological activities, and potential applications* in modern medicine. In doing so, it also identifies current research gaps and proposes directions for future studies to fully harness the therapeutic potential of this remarkable plant.

Plant Morphology

The little plant grows up to maximum of 20 cm and possess unbranched woody erect stem. Leaves: Leaves abruptly pinnate, leaflets opposite, 6 to 12 pairs, and each leaflet is up to 1.5 cm long, the terminal pair is the largest. Flower: The flowers are many and crowded at the apices of the numerous

peduncles, normally yellow, white, or orange with red streak in the center of each of the five petals. The sepals are subulate-lanceolate, striate, and about 7 mm long. Fruits: Fruits are ellipsoid capsules which are shorter than the persistent calyx.[1]

Biological distrubution

Biophytum sensitivum (L.) DC. belongs to the Oxalidaceae family (about 70 species known), native to the tropical areas of South Asia and Africa. B. sensitivum is an annual herb and used in traditional medicine of especially India, Indo-China, the Malaya Archipelago, Madagascar and Africa. Normally, it is present in the shades of trees and shrubs, in grass lands at low and medium altitudes. It is commonly known as Life plant (English). In India, it is also known by various vernacular names, Jhalai (Bengali), Laajjaalu, Lakshmana (Hindi), Hara muni, Jalapushpa (Kannada), Mukkutti (Malayalam), Lajwanti (Marathi), Vipareetalajjaalu, Jhulapushpa (Sanskrit), Nilaccurunki, Tintaanaalee (Tamil), Attapatti, chumi, Jalapuspa, (Telugu). It has been used in traditional medicine for various ailments, especially in Indian medicine.[2,3]

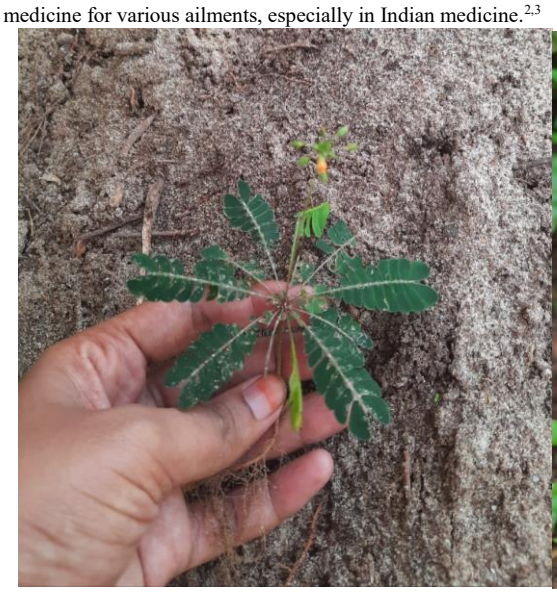

Figure 1 **Figure 2**

Figure 1,2 - Biophytum sensitivum whole plant

Phytochemical constituents

Phytochemical studies of *B. sensitivum* showed that it contains a number of phenolic and polyphenolic compounds, saponin, essential oil, polysaccharides and pectin. The main bioactive constituents found are bioflavonoid, amentoflavone [19]

Flavonoids :Amentoflavone, Isoorientin, Orientin, Apigenin

Phenolic Acids: Caffeic acid, Chlorogenic acid

Tannins :Hydrolyzable and condensed tannins

Saponins :Unspecified, but present

Polysaccharides :Present; bioactive

Others :Terpenoids, glycosides, steroids

Biophytum sensitivum in Ayurveda

It is medicinally used in traditional Ayurvedic and Siddha systems. It is one of the auspicious herbs that constitute the group "Dasapushpam", an Ayurvedic formulation. In ayurveda the plant is familiar as' *Alambusha*' .The properties of this plant are in *Rasa: Katu* ,*Guna* as *Lakhu, Ruksha* and its *Virya* is *Ushna* in nature.[17,] In Ayurveda the reference of *B.sensitivum* not available in Samhita period but in Nighantu period different text books like Bhavaprakasha *Nighantu, Kaiya deva Nighantu, Raja Nighantu* explained about this plant.[17,18]

Table 1-Taxonomy [4,5]

Botanical name	*Biophytum sensitivum*
Kingdom:	*Plantae*
Division	*Magnoliophyta*

Class:	*Magnoliopsida*
Order	*Oxalidates*
Family:	*Oxalidaceae*
Genus	*Biophytum*
Species	*Sensitivum*

Table 2- Vernacular name [4,5]

Common name:	Life plant, Sensitive plant
Sanskrit	Lajjalu, Jalapuspa, Krichhraha, Laghuvrikshaka, Lajjaluka, Panktipatra, Pitapushpa,Alambusha
Hindi	Lakshmana, Lajalu
Marathi	Lajvanti, Jharera, Ladjiri, Lahanamulki
Bengali	Halai
Gujrathi	Jharera
Malayalam	Mukkuti, Nilaccurunki, Tintanali
Kannada	Haramuni, Jalapushpa
Tamil	Nilaccurunki, Tintaanaalee
Telugu	Pulichinta, Attapatti, Chumi, Jala pupa

Pharmacological activities

Immunomodulatory activity

An alcoholic extract of *Biophytum sensitivum* was studied for its immunomodulatory action.
Effect of *Biophytum sensitivum* on cell-mediated immune response was studied in normal as well as Ehrlich ascites tumor bearing BALB/c mice. Administration of *Biophytum sensitivum* significantly enhanced the proliferation of splenocytes, thymocytes and bone marrow cells [12]

Antibacterial activity

The study demonstrates that the leaves extracts of *B. sensitivum* (methanol, chloroform, acetone, and petroleum ether) was evaluated for its antibacterial activity against several human pathogenic bacterial strains (Bacillus subtillis, Staphylococcus aureus, Streptococcus pneumonia, Klebsiella pneumonia, Salmonella typhi, Proteus vulgaris and Escherichia coli) by agar well diffusion method. [6]

Anti oxidant activity

An extract of the medicinal plant, Biophytum sensitivum (L.) DC (Oxalidaceae), was evaluated for its antioxidant potential in vitro and in vivo. Biophytum sensitivum was found to scavenge superoxide radicals generated by the photoreduction of riboflavin and hydroxyl radica[7] .The aim of the present study is to investigate the antioxidant activities of the ethanol, chloroform, petroleum ether and aqueous extracts of Biophytum sensitivum. The ethanolic extracts of B. sensitivum exhibited the highest antioxidant activity (52%) than that of the chloroform (40%), aqeuous (24%) and Petroleum ether (21%) extracts. All the extracts of B. sensitivum exhibited a significant antioxidant activity against DPPH free radicals

Anti-diabatic activity

The effect of the leaf extract of *Biophytum sensitivum*, an annual herb used in traditional Nepalese folk medicine for the treatment of hyperglycemic patients, was studied on glucose homeostasis in rabbits. these observations suggest that the hypoglycemic response of *B. sensitivum* may be mediated through stimulating the synthesis/release of insulin from the beta cells of Langerhans.[8] Another study suggest that BSEt possesses a promising effect on STZ-nicotinamide-induced diabetes.[11]

Hypocholesterolemic effect

study was undertaken to investigate the possible hypocholesterolemic effect of water extract of leaves of Biophytum sensitivum in three groups (of six each) of male albino rabbitS. The study shows that the extract has significant hypocholesterolemic effect.[9]

Radioprotective effect

The radioprotective effect of *Biophytum sensitivum* methanol extract was studied using *in vivo* mice model. The present investigation suggests that the protective effect of *Biophytum sensitivum* on Radiation-Induced hemopoietic damage is mediated through immunomodulation as well as sequential induction of cytokine such as IL-1β, GM-CSF and IFN-γ..[10]

Antiurolithiatic effect

The methanolic whole plant extract of *Biophytum sensitivum* has been found to possess antiurolithiatic effect. The present study was undertaken to evaluate the antiurolithiatic effect of some fractions of methanolic whole plant extract of *B. sensitivum* in rats.[13]

Anti-inflammatory activity

The study was conducted to examines the effect of aerial parts of *B. sensitivum* (methanol extract) on a murine model of ulcerative colitis, induced by intracolonic injection of 3% acetic acid in Wistar rats.[15]

Anti-cancer activity

Anticancer properties of Biophytum sensitivum was exmined by the cytotoxic activity of ethanolic, methanolic and chloroform extracts plant materials in breast cancer MCF-7 cell lines with varying degrees of in vitro cytotoxic potential.[16] The study was investigating experimentally the possible antitumor effects of aqueous extract of Biophytum sensitivum Linn (AEBS) leaves against Dalton's Ascitic Lymphoma (DAL) bearing Swiss albino mice The present work indicates that the aqueous extract of B. sensitivum exhibited significant antitumor activity..[11] The study was conducted to investigated the anti-angiogenic effect of Biophytum sensitivum, using in vivo as well as in vitro models.[14]

Nephroprotective activity

The study was undertaken to evaluate nephroprotective activity of different extracts of whole plant of *Biophytum sensitivum* in Wistar albino rats. The findings revealed that methanol and aqueous extracts of Biophytum sensitivum possesses nephroprotective activity. The elevations of serum urea and creatinine produced by Gentamicin were considerably reduced and showed histopathological changes in the kidneys to normal. The study concluded that *Biophytum sensitivum* possess nephroprotective activity.[20]

DISCUSSION

Biophytum sensitivum, a small annual herb belonging to the family Oxalidaceae, has garnered significant scientific interest due to its extensive range of pharmacological activities and traditional uses. This review consolidates available data on the phytochemical constituents and therapeutic potentials of the plant, aiming to provide a comprehensive understanding of its biological relevance.

The phytochemical profiling of *B. sensitivum* reveals a diverse array of bioactive compounds including flavonoids (notably amentoflavone), glycosides, tannins, saponins, and phenolic acids. Among these, amentoflavone has been repeatedly implicated as a major contributor to its pharmacological effects, especially in anti-inflammatory, antioxidant, and anticancer pathways. The strong antioxidant capacity of the plant, attributed to its polyphenolic content, supports its traditional use in treating oxidative stress-related disorders.

One of the most remarkable findings in the literature is the plant's immunomodulatory and anti-inflammatory potential. Studies have demonstrated that extracts of *B. sensitivum* can significantly modulate the activity of macrophages, lymphocytes, and various cytokines, suggesting potential applications in managing autoimmune disorders and chronic inflammatory diseases. Moreover, the anti-cancer activity of *B. sensitivum*, particularly against Dalton's lymphoma ascites and other tumor models, is promising. The mechanisms seem to involve both immunopotentiation and direct cytotoxicity, although precise molecular pathways remain to be fully elucidated.

Another key area of interest is the anti-diabetic and anti-ulcer activity of the plant. Preliminary studies have reported hypoglycemic effects in animal models, potentially mediated by insulin-sensitizing effects or modulation of carbohydrate metabolism. Similarly, its gastroprotective properties appear to be related to mucosal strengthening and antioxidant effects, although clinical validation is currently lacking.

Despite the broad pharmacological spectrum, most studies on *B. sensitivum* are preclinical and often use crude extracts. There remains a lack of standardization in extract preparation, dosage, and methodology, which hampers reproducibility and the establishment of a clear therapeutic profile. Furthermore, while in vitro and in vivo studies are promising, clinical studies in humans are virtually non-existent. Without this critical step, translating traditional and laboratory findings into clinical applications remains speculative.

Another concern is the potential toxicity and safety profile of *B. sensitivum*. Although the plant is widely used in traditional medicine, comprehensive toxicological assessments are limited. Existing reports suggest low toxicity at therapeutic doses, but long-term safety data are insufficient.

CONCLUSION

Biophytum sensitivum, a small yet remarkable herb, has attracted considerable attention in recent years due to its diverse pharmacological properties and traditional medicinal uses. This review highlights its broad spectrum of bioactivities, including antioxidant, anti-inflammatory, immunomodulatory, anti-diabetic, anti-cancer, antimicrobial, and wound healing properties, many of which are attributed to its rich phytochemical composition—particularly flavonoids, tannins, and phenolic compounds.

Despite the promising preclinical findings, there remains a substantial gap between traditional knowledge and modern scientific validation. Most of the pharmacological studies have been limited to in vitro and animal models, necessitating more rigorous clinical investigations to confirm safety, efficacy, dosage, and mechanisms of action in humans. Furthermore, standardization of extracts, identification of active constituents, and quality control remain key challenges that must be addressed for its integration into mainstream medicine.

In conclusion, *Biophytum sensitivum* holds significant potential as a source of novel therapeutic agents. Continued interdisciplinary research combining ethnopharmacology, phytochemistry, pharmacology, and clinical sciences will be crucial in unlocking its full medicinal value and translating it into evidence-based therapeutic applications.

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